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A Differentially Reinforcing Token System in a Public School Classroom

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A DIFFERENTIALLY REINFORCING TOKEN SYSTEM IN A PUBLIC SCHOOL CLASSROOM

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CHAPTER I

INTRODUCTION

It has been suggested that behavior is acquired as a result of the contingent relationship between the performance of an organism and a consequent event (Skinner, 1938, 1953; Holland and Skinner, 1961; Glasser, 1961; Ferster and Perrott, 1968). There is also experimental evidence to indicate that tokens, later exchanged for primary reinforcement, can be used to control human behavior.

The present study was an attempt to test in a public school classroom the hypothesis that a token reward system can increase academic performance.

Review of Literature

The principles of contingency management have been widely demonstrated in a number of settings where one investigator manages the behavior of one or more children (Ullman and Krasner, 1965; Ulrich, Stachnic, and Mabry, 1966; Bijou and Baer, 1967). Where these principles have been applied to the classroom, praise and other social stimuli connected with the teacher's behavior have been established as effective controllers of children's behavior (Allen, Hart, Buel, Harris, and Wolf, 1964; Becker, Madsen, Arnold,

and Thomas, 1967; Brown and Elliot, 1965; Hall, Lund, and Jackson, 1968; Harris, Johnson, Kelly, and Wolf, 1964; Harris, Wolf, and Baer, 1964; Zimmerman and Zimmerman, 1962).

Other investigators have demonstrated that a contingent conditioned stimulus or token, exchanged later for a reinforcing stimulus, can be used to control behavior (Kelleher, 1957). Token reinforcers are tangible objects or symbols which attain reinforcing power by being exchanged for a variety of other objects such as candy, trinkets, or free time. When tokens are paired with many different reinforcers they acquire generalized reinforcing properties. The generalized reinforcer is especially useful since it is effective regardless of the momentary condition of the organism (O'Leary and Becker, 1967).

O'Leary and Becker (1967) have indicated that a token reinforcement system can be effective where other reinforcements, such as praise, teacher attention, stars, and grades, are found to be ineffective in maintaining appropriate behavior. After obtaining a base rate of deviant behavior for the eight most disruptive children in a third grade class, the experimenters instituted a token reinforcement program where the children received teacher's ratings which were exchangeable for reinforcements such as candy and trinkets. An abrupt reduction in deviant behavior occurred with the introduction of the token system. Delay

of reinforcement was gradually increased to four days without increase in deviant behavior. The program was equally successful for all children observed.

Perline and Levinski (1968) have described a token reinforcement program used to modify maladaptive classroom behaviors of four severely retarded children, ages eight to ten, in a residential pre-school setting. Two experimental conditions were applied: (1) All children were given tokens, later exchanged for tidbit reinforcers, contingent on those responses incompatible with five specific maladaptive behaviors and appropriate to teacher requests. Upon the emission of a maladaptive response, a token was taken away. In addition, for one-half of the subjects, a time-out period was made contingent on maladaptive behavior. (2) The same procedure used without time-out.

The experimenters noted a significant decrement between the pre- and post-maladaptive response rate and concluded that the token system was highly effective in decreasing maladaptive behaviors in a class setting. It is regretable that no statement was made as to the effect upon appropriate behavior for which tokens were given. Moreover, the authors failed to report whether appropriate behaviors showed a parallel increase with the decrease of maladaptive behaviors.

It has also been demonstrated that the behaviors of psychotic mental patients may be brought under contingency

control by the use of a token system (Ayllon and Azrin, 1965). In the study it was found that responses which were necessary or useful to the patient could be maintained at a high rate if patients were allowed to exchange metal tokens, contingent upon the appropriate behaviors, for other activities which the patient desired as indicated by his behavior.

Premack (1959) has suggested that any behavior of an organism with a high frequency of occurrence can be used as a reinforcer upon any behavior of the organism with a low frequency of occurrence.

Girardeau and Spradlin (1964) have cited the effectiveness of a token system in an institution for the training of moderately and severely retarded girls. In the institution tokens were established as generalized reinforcers by making them redeemable in foods, soft drinks, jewelry, clothing, and novelties. The tokens were delivered immediately to the children whenever they were engaged in constructive socially acceptable activities. As soon as a girl received tokens, she could go to the canteen and trade the tokens for the above reinforcers. While the tokens were originally given for appropriate social behavior, their effectiveness was later demonstrated in a classroom setting where the tokens were used as positive reinforcement of academic behavior.

Birnbrauer and Lawler (1964) have indicated the success of a token reinforcement system in another institution for young severely retarded children. In the institution the token system has been highly effective where other procedures used previously had not. The investigators found that M & M's first used as tokens on a continuous schedule to approximations of desired terminal behavior could be later replaced by poker chips that represented eventual exchange for many items, e.g., M & M's, candy bars, balloons, whistles, and other edibles and trinkets.

In another study it was found that high frequency inappropriate classroom behavior of female institutionalized adolescent offenders was readily modifiable by means of an operant procedure (Meichenbaum, Bowers, and Ross, 1968). The study tested a token system in establishing and maintaining appropriate classroom behavior where the subjects display a great variety of undesirable classroom responses with only sporadic examples of appropriate behavior. The token system consisted of slips of paper denoting amounts of money for which the slips could be later exchanged. The slips of paper were delivered to the subjects on various schedules of reinforcement. While the investigators reported the success of the operant token system as a whole, they were unable to assess the effectiveness of the various schedules of reinforcement. An additional

finding was that teachers not trained in operant procedures can modify the behavior of female juveniles in the desired direction when given experimenter guidance.

In a study by Hawkins, Peterson, Schweid, and Bijou (1966) it was found that a mother may be highly effective as a contingency manager even when she has no training in operant methodology. In this study the mother of a conduct problem child was given verbal directions by the experimenters in the manipulation of her behavior. As a result of her manipulations, the child's undesirable behavior rate showed a significant decrement.

While the above token systems have demonstrated the effectiveness of operant methods in the change of undesirable behavior for more positive social behavior, it has remained for other studies to show that when undesirable behavior is reduced, academic achievement is enhanced (O'Leary, Becker, Evans, and Saudargas, 1969; Birnbrauer, Wolf, Kidder, and Tague, 1965). It appears that the reinforcement of generally appropriate classroom behaviors produces academic performance increments even though reinforcement is not specific to academic performance, such as test scores.

When token systems have been applied directly to test performance, significant gains have been observed. Clark, Lachowicz, and Wolf (1968) have indicated the success of

a token system with school dropouts. In the study five female school dropouts were "hired" to complete remedial workbook assignments. They were paid via a token system for the items they worked correctly. The subjects were "hired" to work in a classroom for 17 hours a week and received points for correct answers to the instructional materials. Each point was the equivalent of about two cents. With these points they were allowed to purchase commodities at a local store. Results of the study indicated a significant gain for the experimental group on the California Achievement Test as compared to a control group. In general the results indicate that the overall remedial program was effective in substantially increasing the academic skills of the students in a relatively short period of time.

Tyler and Brown (1968) have successfully used a token reinforcement system to elevate test scores of court-committed boys, ages 10 to 15, in a public training school. In this study subjects observed a daily television newscast and were administered a 10 item true-false test based on the program's content the next morning. Upon returning to their cottage in the afternoon, those subjects on contingent reinforcement were paid tokens for the scores they had earned on the test. The tokens were redeemable for canteen items (candy, gum, etc.) and privileges in the

cottage. The investigators found significant increases in test performance with the institution of the token system and also a significant increase in the scores of the token group as compared to another group of youngsters who were paid an equivalent "salary" not contingent upon their test scores.

The effectiveness of token reward systems has been demonstrated by Wolf, Giles, and Hall (1968) in a remedial educational program for low-achieving fifth and sixth grade children of an urban poverty area. In the program 16 pupils from two elementary schools attended a remedial education center during the summer. The reinforcement procedure resembled a trading stamp plan. Each child was given a folder containing groups of four different colored pages. After a child completed an assignment correctly, he was given points by the teacher who marked the squares of the appropriately colored pages with a felt pen. Filled pages of points were redeemable, according to their color, for a variety of goods and events: blue pages for weekly field trips; green pages for a daily snack; pink pages for money and items available in a "store"; yellow pages for long range goals such as a bicycle. The students benefited substantially from the remedial program. Not only did they gain, on the average, a full year's advancement in their achievement level; they also gained an additional

half year in their previously accumulated deficit. Additionally, by varying the amount of points per task, the investigators found that optimum performance on any task was related to the amount of reinforcement .

Other investigators have also found token systems effective with children who have learning disabilities (McKenzie, Clark, Wolf, Kothera, and Benson, 1968). The investigators found that grades, given at the end of each week, can serve as tokens. The parents of each child agreed to pay an allowance based upon the token grades. It was found that a pay for grades token reinforcement system can increase academic behavior to levels higher than those incentives, such as recess, free time, or teacher attention which are usually available in the school.

Token reinforcement systems in the classroom have, for the most part, involved a number of experimenters or aids working with the teachers of remedial, custodial, institutional, or otherwise "special" classes. A recent investigation has given some indication that operant techniques have validity in the classroom not defined as unusual or exceptional.

Lovitt, Guppy and Blattner (1969) have conducted an investigation in a fourth grade class of 32 pupils in a public school. The study assessed spelling performance

of the group as a function of three conditions: (1) when traditional procedures were in effect, (2) when contingent free-time was individually arranged, and (3) when a group contingency, listening to the radio, was added to the individually obtained free-time. As a result of the procedures, the majority of the pupil's spelling performance increased, indicating that the use of contingent free-time and radio listening were effective reinforcers.

While token systems have proved effective in many instances, one study (Martin, Burkholder, Rosenthal, Tharp, and Thorne, 1968) has demonstrated that a behavior change program using a token reinforcement system can be made even more effective if subjects are provided with modeling stimuli and have the goals of the academic program carefully divided into a sequence of steps in addition to the token reward.

Kuypers, Becker and O'Leary (1968), citing a token program that was marginally effective, have suggested several variables that may reduce the maximum potential of token systems. Six third-grade and six fourth-grade students received points in a notebook contingent upon appropriate behavior. The points were redeemable for prizes such as candy, gliders, balls, pencils, and clay.

Some possible weaknesses of the experimental design suggested by the investigators were: (1) tokens or points

were given for meeting an absolute standard rather than for improvement, (2) a shaping procedure was not used by the teacher, (3) no attempt was made to systematically apply differential social reinforcement between the times when points were awarded, (4) the teacher in this study was not trained through a workshop in the systematic application of behavioral principles, and (5) the teacher in the study did not consider the level of deviant behavior to be abnormal. Because of her capacity to tolerate disruptions, she may have been more flexible in conducting the program than the investigators had intended. It remains for later research to establish the relationships between the many variables involved in token classroom systems and behavior control.

Hypotheses

If token reward systems do exert control of behavior in the classroom, it should be possible to test the various hypotheses: (1) A token reward system increases academic test performance in a classroom not defined as exceptional, (2) The increase in test performance is equivalent across academic courses, (3) In terms of maximum performance there are optimum levels of reinforcement.

CHAPTER II

METHOD

Subjects

Subjects for the experiment were 21 eighth-grade students from a public junior high school in an affluent suburban area. Ten of the subjects were girls; eleven were boys. One subject, a girl, had been retained in the second grade and was 15 years old. All other subjects were in the usual grade sequence. Eight of the subjects were 14 years old and 12 of the subjects were 13 years old when the experiment began.

The subjects were assigned to the teacher each day for three 45 minute periods of instruction in English, United States history, and spelling.

By the standards of the school, the subjects were characterized as "average" in classroom conduct and academic performance. The teacher did not consider any of the subjects behavior as greatly annoying or exceptional. Two subjects had been placed on the school's honor roll with at least a 3.0 average the previous semester and one subject had received two failing report card grades the previous semester. All the other subjects had received a majority of "C" grades with a few "D" and "B" grades.

Selection of Subjects

During the six weeks of the pre-experimental baseline period which began during the second semester of the school year, the teacher taught her class as she had the previous semester. Throughout the baseline and experimental phases the subjects were given tests prepared by the experimenter and administered by the teacher. The tests were based on the content of the material the teacher was presenting in English, history, and spelling. Each test consisted of 30 one-point questions sampled at random from the test manuals of English in Action (1956), Basic Keys to Spelling (1962), and This is America's Story (1964).

The teacher selected the day and time of each test and indicated to the experimenter the sections of each textbook from which the students were to be tested. Test items were prepared by the investigator and delivered to the teacher, so that she had no knowledge of the test while she was teaching each unit of study.

During the baseline period a record was maintained of each student's performance on the 30 point tests in each course. At the conclusion of the baseline period an average test score was determined for each subject in each of the three courses. At this point the subjects were ranked from highest to lowest for each course of study, then ranked highest to lowest across the three courses

(For instance, the subject ranked number one across courses had a rank of one in history, two in English, and one in spelling for an average rank of 1.33. The subject ranked number two across courses had a rank of two in history, one in English, and three in spelling for an average rank of 2.00).

After the subjects had been ranked across courses, three groups of seven subjects were selected by random sampling from units of three subjects, beginning with the three highest ranking subjects and continuing to the three lowest ranking. The three groups were designated Group 1/4, Group 1/2, and Group 3/4 on a random basis.

As a result of this procedure each group had an equivalent baseline average within each course. The averages across courses were not equivalent.

Method

At the beginning of experimental phase I, which lasted for a period of four weeks, the subjects were given slips of paper on which were listed the score averages they had earned in each of the three courses. They were given the following instructions by the teacher:

> (1) From now on I am going to slightly change the class situation in hopes of improving your test scores.
>
> (2) I will continue to give tests in English, history, and spelling, but I will not place any grades on the tests.

(3) During each week as you earn points on tests, I will put them on the chart at the front of the room. Many of you may find more points on the chart than you have earned on tests, because I will give bonus points if you score above your present averages.

(4) Beginning next Monday and each Monday following, you will be able to buy your grades for all of the tests taken during the previous week. I am going to charge you 27 points for an A, 24 points for a B, 20 points for a C, and 16 points for a D. In terms of the points you have accumulated, you may buy any combination of grades; however, if you do not buy at least a D grade for any test I will have to give you an F for that test.

(5) Some of you may not spend all of your points for grades, as I will allow you to buy other things with the points you have earned. A chart of these things has been put on the bulletin board. If you should want to purchase any of these things, all you need to do is to write your name, the activity, and number of points it will cost on a slip of paper and I will deduct the points from your total.

Throughout experimental phase I the subjects were tested by the teacher with the tests prepared by the experimenter. For every item that a subject correctly answered, he was given one point. If on any test a subject achieved above his baseline average for that course he was given a bonus determined by his group membership. The bonus for the subjects in Group 1/4 was 1/4 of the difference in points between the actual test score and the maximum possible score of 30. The bonus for the subjects in Group 1/2 was computed in the same manner except that these subjects could receive 1/2 of the difference between the actual test score and the maximum of 30. The subjects

in Group 3/4 could earn 3/4 of the difference between the actual test score and maximum possible as their bonus.

For instance, subject 3 had a baseline of 18.4 points in spelling and achieved a score of 21 on the first spelling test of experimental phase I. He received 21 points for his test score and since he was in Group 1/4, two points as a bonus (1/4X30-21=2.25), for a total of 23 points.

Subject 14 had a baseline average of 14.8 in history and achieved a test score of 13 for the first history test of experimental phase I. He received 13 points for the test score he had achieved, but no bonus points as the test score was below his baseline average for history.

Subject 16 with a baseline average of 23.3 in English achieved a test score of 30 on the first English test of experimental phase I. She received 30 points, but no bonus as 30 was the maximum number of points possible from any one test.

Throughout the four week period of experimental phase I, the teacher allowed the subjects to purchase the items listed in table I and on each Monday had the students spend their accumulated points for test grades. At this time the teacher also handed each subject a slip of paper indicating his average test score in each course for the succeeding week if the student's average had risen. If any averages had not risen, the average indicated on his

TABLE 1

Point Values for Reinforcers in Addition to Grades: Experimental Phase I

Reinforcer	Point Value
Free Time (Last 10 minutes of period)	10
Longer Breaks	1 point per minute to a maximum of 5 minutes
Party (One period every other week)	25
Games (Last 1/2 hour of period)	12
Grab Bag (Trinkets worth 25¢ each)	15
Take Home Charts	10
Special Projects (Any academic project agreed upon by teacher outside of class)	10 points to earn a possible 25 from project
Work Assignments (Assignment to office or counselor for one period)	15

slip was the highest he had previously achieved.

At the end of four weeks under the experimental condition the data appeared to indicate some reinforcement satiation. It was decided to increase the point values of both grades and additional reinforcers. This period of the experiment was designated experimental phase II and lasted an additional four weeks.

During experimental phase II the point value of test grades was increased to 30 points per A, 27 points per B, 24 points per C, and 21 points per D. New point totals for additional reinforcers are shown in table II. No other changes were made in the experimental design for experimental phase II.

Throughout all phases of the experiment the subjects were tested every second day in each course.

Throughout all phases of the experiment the teacher conducted her class with no assistance from aides or the investigator, with the exception that the investigator gave the teacher direction as to procedure and provided her with tests and maintained a record of all data.

TABLE 2

Point Values for Reinforcers in Addition to Grades: Experimental Phase II

Reinforcer	Point Value
Free Time	20
Longer Breaks	2 point per to a maximum of 5 minutes
Party	50
Games	25
Grab Bag	30
Take Home Charts	20
Special Projects	20 points to earn a possible 40 from project
Work Assignments	30

CHAPTER III

RESULTS

Raw scores of subjects through all phases of the experiment are illustrated in Tables A through F of Appendix A. For statistical analysis the experimental variables were defined as A (reinforcement condition: A_1 = Group 1/4, A_2 = Group 1/2, A_3 = Group 3/4), B (course: B_1 = history, B_2 = spelling, B_3 = English), and C (experimental level: C_1 = baseline, C_2 = experimental phase I, C_3 = experimental phase II).

Effects

The data was first analyzed using an analysis of variance three by three with three repeated measures design (Kirk,1969). Results for all effects (Table 3) indicated a significant difference in the B variable, the level of performance across courses. In addition significant effects were found across the C variable, experimental levels, and within the interaction of the A and C variables, experimental levels across reinforcement conditions.

Table 4 indicates the total point accumulation for all groups in English, history, and spelling across all levels of treatment. It was apparent that subjects earned

TABLE 3

Analysis of Variance for Main Effects

Source	SS	df	MS	F
Between Subjects	1392.71	20		
A	67.59	2	33.97	.46
subj. w. groups	1325.12	18	73.62	
Within Subjects	3143.94	168		
B	1994.13	2	997.07	102.37**
AB	8.97	4	2.24	.23
B x subj. w. groups	350.55	36	9.74	
C	188.64	2	94.32	24.82**
AC	54.30	4	13.58	3.57*
C x subj. w. groups	136.75	36	3.80	
BC	28.45	4	7.11	1.40
ABC	17.28	8	2.16	.43
BC x subj. w. groups	364.87	72	5.07	
Total	4536.65	188		

*$p < .05$
**$p < .01$

TABLE 4

Accumulated Course Points
As a Group Average

	History	Spelling	English
Group 1/4	341.03	491.63	480.82
Group 1/2	343.68	486.39	480.77
Group 3/4	311.10	454.58	465.58
Total	15,740.27	32,576.86	32,343.07

less than 50% as many points in history as in English and spelling.

Table 5, accumulated raw scores for each reinforcement group across treatments, shows that Groups 1/4 and 1/2 displayed accelerating performance under both experimental conditions phase I and phase II, as compared to baseline, while Group 3/4 first displayed a performance increase in phase I, then a performance decrease in phase II as compared to baseline.

The analysis for simple effects (Table 6) revealed significant differences in the performance of Groups 1/4 and 1/2 across experimental levels, but no significant departure from baseline for Group 3/4.

The comparison among means (Table 7) by Tukey's Ratio (Kirk, 1969) indicated that both Groups 1/4 and 1/2 displayed reliable performance differences in phase I and phase II as compared to baseline, but neither group achieved significantly different scores in phase II as compared to phase I.

Comparisons of means for courses (Table 7) indicated a significant difference between the lower rate of performance in the history task as compared to the higher rates for English and spelling. The English and spelling tasks did not differ significantly.

The interaction of reinforcement condition across

TABLE 5

Accumulated Points Across Treatments
As a Group Average

	Baseline	Experimental Phase I	Experimental Phase II
Group 1/4	403.47	462.01	488.00
Group 1/2	399.25	455.85	456.74
Group 3/4	405.79	421.68	404.07
Total	1,208.51	1,339.54	1,308.81

TABLE 6

Analysis of Variance for Simple Effects

Source	SS	df	MS	F
Between Subjects				
Between A at C_1	1.43	2	.71	.03
Between A at C_2	44.96	2	22.48	.83
Between A at C_3	75.87	2	37.96	1.40
Within Cell	1461.87	54	27.07	
Within Subjects				
Between C at A_1	88.98	2	44.49	11.74**
Between C at A_2	103.32	2	51.56	13.63**
Between C at A_3	8.97	2	4.49	1.18
AC	54.30	4	13.58	3.58*
C x subj. w. groups	136.75	36	3.79	

*$p < .05$
**$p < .01$

TABLE 7

Comparisons Among Means

C_1 with C_2 at A_1	q = 6.56**
C_1 with C_3 at A_1	q = 4.99**
C_2 with C_3 at A_1	q = 1.57
C_1 with C_2 at A_2	q = 6.34**
C_1 with C_3 at A_2	q = 6.44**
C_2 with C_3 at A_2	q = .09
B_1 with B_2	q = 17.00**
B_1 with B_3	q = 16.75**
B_2 with B_3	q = .25

**$p < .01$

experimental levels is pictured in Figure 1. This interaction resulted in continued accelerating performance across all experimental levels for Group 1/2 while both Groups 1/4 and 3/4 first displayed increased performance in experimental phase I, then a performance decrement in experimental phase II.

Points accumulated for all subjects across courses is illustrated in Table 8. In addition the reinforcements selected by each subject was recorded. With little exception grades emerged as the most common reinforcer.

Finally, Table 9 indicates the mean scores of each subject across courses for all levels of the experiment. While it was expected that the bonus advantage of Group 3/4 would tend to elevate the subjects individual scores, the effect was not found.

Even though Groups 1/4 and 1/2 displayed increased performance through the experimental phases, individual differences are evident.

FIGURE 1

Interaction Between Reinforcement Condition and Experimental Level

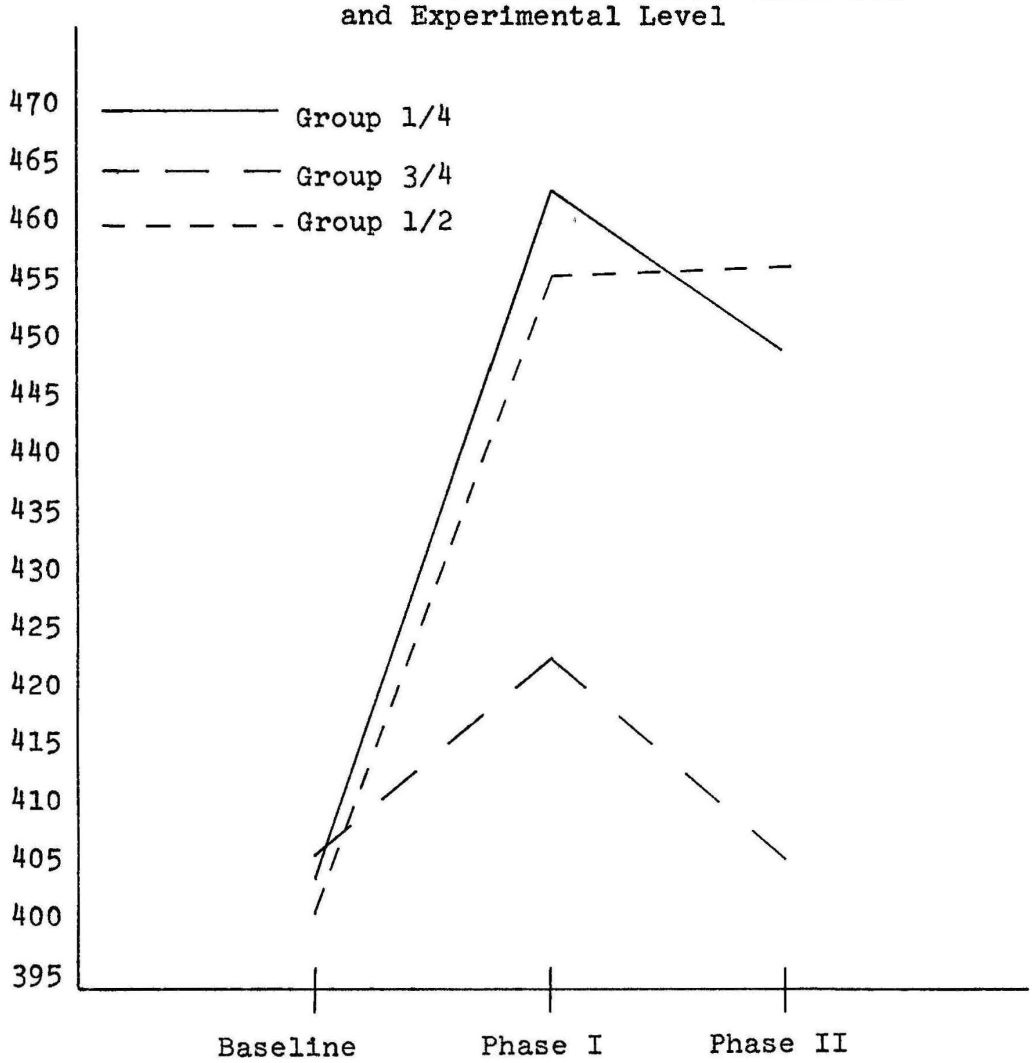

TABLE 8

Points Earned and Consumed During Phases I and II

Subjects		Points Earned				Points Consumed	
		History	Spelling	English	Total	Grades	Other
Group - 1/4	1	205	278	365	848	820	28
	2	166	259	350	775	750	25
	3	176	211	282	669	665	4
	4	195	235	321	751	630	121
	5	168	232	304	704	781	23
	6	236	291	381	908	895	13
	7	219	248	345	812	702	110
		1365	1754	2348	5467		
Group - 1/2	8	247	274	349	870	860	10
	9	214	290	303	807	537	270
	10	197	274	362	833	801	32
	11	239	277	342	858	598	260
	12	226	198	355	779	724	55
	13	165	235	321	721	690	31
	14	186	215	332	733	641	92
		1474	1763	2364	5601		
Group - 3/4	15	187	227	308	722	649	73
	16	191	263	343	797	731	68
	17	218	275	348	841	829	12
	18	195	211	329	735	591	144
	19	239	254	313	806	711	95
	20	88	142	319	549	502	47
	21	164	231	314	709	648	61
		1282	1603	2274	5159		

TABLE 9

Subjects Mean Performance Across Course and Experimental Level

		History			Spelling			English		
	Subjects	Baseline	Phase I	Phase II	Baseline	Phase I	Phase II	Baseline	Phase I	Phase II
Group - 1/4	1	19.25	19.33	16.80	25.38	26.00	28.80	20.23	28.06	25.28
	2	12.50	16.00	11.60	23.15	26.20	25.60	20.38	24.71	24.71
	3	14.75	14.50	14.20	18.38	20.60	19.80	14.31	21.14	18.00
	4	15.83	15.66	16.20	21.38	20.00	24.60	24.08	22.86	22.14
	5	11.33	14.67	12.40	14.08	23.20	22.20	16.77	22.57	20.71
	6	19.75	20.83	21.20	29.15	28.60	29.60	27.38	28.42	27.42
	7	17.00	18.83	18.40	16.31	23.40	25.20	22.08	26.43	23.14
Group - 1/2	8	17.17	19.83	19.40	25.77	26.20	28.20	23.85	25.71	23.57
	9	12.83	15.17	14.60	14.54	27.20	29.20	16.08	21.29	20.14
	10	18.91	14.83	20.20	27.00	25.80	28.80	22.00	26.57	26.29
	11	13.43	16.67	18.80	18.08	25.80	29.20	16.31	26.14	22.43
	12	17.33	19.50	18.20	16.38	17.40	17.40	24.15	24.14	24.71
	13	14.83	17.00	12.60	23.85	23.00	22.80	22.77	23.86	20.86
	14	12.58	17.00	12.80	18.77	18.60	22.40	22.62	23.14	24.14
Group - 3/4	15	11.83	12.50	11.20	17.31	22.80	20.80	20.38	20.57	22.57
	16	18.08	18.50	14.20	25.92	25.60	27.00	23.30	26.00	22.71
	17	18.25	19.50	17.60	27.62	26.60	28.40	24.46	26.14	23.14
	18	14.42	17.83	13.20	22.77	19.60	21.60	25.69	23.00	23.71
	19	14.00	17.33	17.20	23.39	23.40	24.00	24.62	19.57	23.71
	20	14.08	8.86	8.20	13.92	13.20	9.80	11.00	19.57	20.29
	21	15.75	16.17	12.40	17.85	21.80	21.20	21.15	23.14	21.14

CHAPTER IV

DISCUSSION

As Groups 1/4 and 1/2 displayed increased academic performance under the experimental conditions, the present data support the belief that a token reward system can be effective in increasing academic response rate in a classroom setting. However, the assumption that the increase in performance was due solely to the token system cannot be made because of the lack of a control group. The lack of a control group resulted from conducting the study in a single classroom.

The weakness of no control group could have been overcome if the subjects had been returned to baseline conditions at the conclusion of the study. This return to baseline would have allowed the experimenter to use subjects as their own controls. However, the ending of the school year prevented the return to baseline conditions.

While Group 3/4 had the opportunity for maximum reinforcement, these subjects never achieved above baseline performance. It appeared that Group 3/4 subjects were either satiated or able to gain reinforcement without expending the energy necessary to significantly increase above baseline performance. Groups 1/4 and 1/2, however,

had to increase their rate of performance if they were to achieve reinforcement equivalent to Group 3/4.

The differential effect of the token system on the performance of individual subjects was quite evident (Table 9). Some subjects made marked gains under the experimental conditions, some subjects made slight or no gains, and some subjects displayed decreased performance.

While individual subjects were matched as to baseline performance no anticipation could have been made as to which subjects would respond to the reward contingencies. Subjects nine and eleven spent 270 and 260 points, respectively, for rewards in addition to grades, while subject three spent only four points for rewards in addition to grades (Table 8). The reward pool was obviously limited and there is no reason to suppose that reinforcing contingencies were available for all subjects. The experimental program may have been more successful if the behavior of the individual subjects had been observed for a period of time and reinforcements selected that appeared to maintain high frequency behavior of the individual subjects. This approach has been suggested by Premack (1959) and used in a successful experiment by Ayllon and Azrin (1965).

It has been suggested by Sidman (1962) that tokens will be effective only to the extent that the exchange items are varied and sufficiently valuable to subjects.

The interaction of the reinforcement condition versus experimental level has been illustrated in Figure 1. If it is true that subjects will increase performance to obtain reinforcement as Group 1/2 did in phase II then it would also hold that Groups 1/4 and 3/4 should also have increased rates under phase II. In general the token system was effective in increasing performance of subjects at the lower reinforcement levels. Since the performance of subject groups across experimental conditions displayed an interaction unexplainable by level of reinforcement it may be premature to suggest that the present data can account for the relationship of performance to differential levels of reinforcement.

It had been hypothesized that an increase in test performance would be equivalent across academic courses. The present data support this hypothesis.

Most of the studies utilizing token systems have been conducted in classrooms defined as exceptional. (However, the present study was conducted in a more typical public school classroom and found some success with a token system.) Thus, it appears that operant procedures and techniques have a broad range of application in many varied academic settings.

Finally, the token system was conducted in the classroom only by the classroom teacher. While the experimenter

directed the study and assisted by providing tests and maintaining records, he was not involved in the actual conduct of the study in the classroom. The teacher reacted to the experiment by indicating: (1) the students enjoyed the novelty of the token system, (2) some students made marked academic gains, and (3) the program involved little additional work on her part.

In conclusion three weaknesses of the study should be cited: (1) Subjects were allowed to accumulate points throughout the experimental phases. The satiation effect for Group 3/4 may have been reduced if point consumption were limited to a weekly period. (2) The limited time available for the study prevented varying any reinforcement level beyond two phases. It would have been more enlightening if the reinforcement level could have been varied through several phases including a return to baseline. (3) The upper limit for some subjects' performance level could not be determined as tests were limited to 30 points and all subjects had the same number of tests.

CHAPTER V

SUMMARY

A token reinforcement program was instituted in a public school classroom whereby subjects received various reinforcements in addition to grades contingent upon academic test performance.

Differential amounts of reinforcement were delivered to three matched groups.

Results indicated: (1) The token system was effective for the two groups at the lower levels of reinforcement. (2) An interaction between level of reinforcement and experimental condition was observed. (3) The data indicate some difference in the nature of the English, spelling and history tasks.

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APPENDIX A

TABLE A

Raw Scores Per Subject - English

	Subject	Baseline												
Group - 1/4	1	12	30	27	25	15	21	4	24	30	27	12	9	27
	2	24	21	21	23	13	26	12	15	30	21	15	26	18
	3	14	10	20	14	9	13	9	0	30	28	8	11	20
	4	17	26	27	30	17	26	27	30	30	28	13	21	21
	5	9	24	21	28	10	21	0	30	26	24	3	7	15
	6	30	28	27	26	23	29	27	30	30	25	27	30	24
	7	20	28	27	22	21	26	27	27	24	20	11	16	18
Group - 1/2	8	19	28	28	29	19	22	25	27	28	24	6	30	25
	9	19	20	30	17	5	0	25	30	20	23	0	13	7
	10	0	23	27	26	25	26	19	18	26	23	19	27	27
	11	24	22	22	25	25	26	9	19	26	0	3	11	0
	12	14	26	28	26	20	26	24	28	30	22	22	26	22
	13	17	26	25	28	14	25	16	30	27	22	18	26	22
	14	16	26	30	16	26	24	25	27	29	20	9	27	19
Group - 3/4	15	18	16	24	20	22	28	0	9	27	26	18	30	27
	16	9	28	20	28	24	28	9	30	30	28	17	28	24
	17	22	26	27	29	20	18	21	27	30	24	20	30	27
	18	29	26	18	27	22	28	18	24	27	28	27	30	29
	19	25	30	27	28	21	23	30	30	28	22	15	20	21
	20	19	26	15	0	7	0	0	0	28	15	4	5	24
	21	14	28	18	26	15	26	9	24	30	23	19	19	24

TABLE B

Raw Scores Per Subject - English

	Subject	Phase I							Phase II						
Group - 1/4	1	26	26	25	23	30	24	30	24	30	27	24	25	25	22
	2	20	17	30	26	29	27	24	30	30	27	18	27	24	17
	3	14	16	27	23	24	21	23	12	28	18	25	19	4	20
	4	30	11	29	19	24	18	29	27	26	25	22	22	16	17
	5	28	18	29	18	30	15	20	27	24	21	21	19	17	16
	6	30	30	24	25	30	30	30	25	30	25	27	30	25	20
	7	29	29	30	22	24	27	24	27	30	29	16	25	19	16
Group - 1/2	8	27	24	20	22	30	27	30	27	30	24	21	24	19	20
	9	18	25	29	4	22	27	24	21	30	22	18	17	19	14
	10	30	30	30	18	30	24	24	22	30	26	24	29	17	26
	11	28	30	30	13	28	30	24	27	30	20	17	28	17	18
	12	25	25	30	18	30	24	24	22	30	26	24	24	23	24
	13	22	24	30	19	26	22	24	21	30	18	14	24	22	17
	14	17	29	30	13	16	27	30	25	29	26	24	22	21	22
Group - 3/4	15	15	28	30	12	28	15	16	24	28	21	27	17	19	22
	16	29	29	30	25	28	15	26	15	30	24	20	27	20	23
	17	30	29	30	25	28	15	26	15	30	24	20	28	23	22
	18	29	30	30	21	30	2	19	17	30	28	19	29	22	21
	19	20	26	25	4	20	18	24	30	28	29	17	25	19	18
	20	21	17	22	6	22	27	22	24	30	20	18	14	16	20
	21	27	23	27	20	23	12	30	24	28	18	13	27	20	18

TABLE C

Raw Scores Per Subject - Spelling

	Subject	Baseline												
Group - 1/4	1	24	22	25	27	30	30	28	18	30	28	16	30	22
	2	21	23	30	23	21	30	25	30	18	26	10	20	24
	3	16	11	19	16	20	18	24	18	6	24	18	21	28
	4	20	15	20	26	25	20	26	12	22	14	30	22	26
	5	11	11	16	21	18	16	14	8	13	14	10	24	8
	6	30	28	29	28	28	30	30	30	26	30	30	30	30
	7	12	16	14	15	17	20	20	16	14	20	16	16	16
Group - 1/2	8	28	26	28	28	27	30	30	14	24	30	30	30	10
	9	15	13	9	0	18	30	30	5	0	12	22	18	17
	10	30	30	25	30	28	28	16	22	30	24	30	30	28
	11	7	8	7	11	20	28	30	4	16	22	30	28	24
	12	4	22	22	23	16	30	24	6	18	10	16	10	12
	13	26	19	26	25	24	26	24	22	24	26	26	18	24
	14	18	13	19	28	26	30	24	18	18	12	14	16	8
Group - 3/4	15	10	16	23	15	21	26	20	10	16	24	26	8	10
	16	21	23	28	27	29	22	19	26	30	26	30	26	30
	17	22	25	23	30	27	26	30	26	30	30	30	30	30
	18	20	28	26	27	27	28	26	24	16	10	26	16	22
	19	20	24	30	26	18	24	30	22	18	28	22	26	16
	20	15	14	16	22	18	18	12	18	0	10	10	16	12
	21	16	20	21	24	23	10	22	8	20	14	18	16	20

TABLE D

Raw Scores Per Subject - Spelling

	Subject	Phase I	Phase II
Group - 1/4	1	28 22 30 22 28	30 30 28 28 28
	2	22 25 30 24 30	30 30 24 26 18
	3	20 18 24 16 25	26 22 12 20 19
	4	22 21 20 13 24	24 30 27 20 22
	5	28 10 18 30 30	24 28 15 24 20
	6	30 30 30 23 30	30 28 30 30 30
	7	28 18 24 17 30	30 30 26 28 12
Group - 1/2	8	24 22 30 25 30	30 30 30 26 25
	9	28 24 26 28 30	26 30 30 30 30
	10	30 26 30 13 30	30 30 30 28 26
	11	30 16 30 23 30	30 30 26 30 30
	12	20 16 26 13 12	22 21 14 12 18
	13	26 16 30 13 30	22 22 18 26 26
	14	22 12 24 17 18	30 26 24 14 18
Group - 3/4	15	26 10 30 18 30	26 24 16 26 12
	16	30 20 30 18 30	30 28 25 30 22
	17	30 24 30 19 30	30 30 30 30 22
	18	22 18 30 10 18	30 24 22 18 14
	19	24 26 28 21 18	24 30 16 24 26
	20	22 14 30 0 0	15 16 18 0 0
	21	26 14 22 23 24	26 28 16 22 14

TABLE E

Raw Scores Per Subject - History

	Subject	Baseline											
Group - 1/4	1	25	19	29	15	16	25	16	15	17	24	12	18
	2	20	15	20	14	14	12	7	9	9	11	7	12
	3	15	20	20	14	13	25	14	13	18	12	0	13
	4	19	17	23	16	14	23	16	16	17	19	10	0
	5	0	11	18	13	11	18	19	7	11	13	8	7
	6	27	16	27	14	18	25	19	14	19	24	15	19
	7	18	16	26	14	16	23	22	11	14	21	8	15
Group - 1/2	8	25	21	21	11	20	24	16	11	12	16	16	13
	9	15	6	18	3	13	23	12	9	8	15	15	17
	10	21	20	20	16	15	28	20	15	22	22	15	13
	11	15	9	20	13	9	21	16	10	13	17	5	13
	12	24	20	24	17	19	21	17	12	19	10	10	15
	13	22	19	23	11	10	19	13	4	15	19	12	11
	14	20	10	14	16	19	20	17	4	11	7	7	6
Group - 3/4	15	0	9	18	16	11	22	14	12	11	9	9	11
	16	26	21	26	16	13	25	15	11	20	16	13	15
	17	20	19	23	18	19	26	14	11	16	21	13	19
	18	9	14	27	8	17	23	14	13	12	18	8	10
	19	20	24	21	15	24	0	14	0	14	8	13	15
	20	26	19	21	10	0	24	15	12	9	17	5	11
	21	20	18	22	12	18	21	16	8	15	16	14	9

TABLE F

Raw Scores Per Subject - Spelling

	Subject	Phase I	Phase II
Group - 1/4	1	13 30 16 13 20 24	19 16 17 15 17
	2	11 27 14 13 15 16	10 9 9 14 16
	3	10 16 17 14 18 12	17 8 16 16 14
	4	0 16 27 14 16 21	20 12 18 14 17
	5	10 20 10 14 15 19	12 11 14 15 10
	6	16 30 22 18 14 25	20 24 17 25 20
	7	18 30 10 14 19 22	20 19 17 20 16
Group - 1/2	8	14 30 17 16 20 22	19 21 17 20 20
	9	14 16 13 13 14 21	15 19 9 14 16
	10	7 16 7 15 16 28	16 17 20 22 26
	11	16 16 11 17 19 21	12 21 18 23 20
	12	17 26 19 17 18 20	16 20 17 14 24
	13	14 30 14 16 12 16	16 10 11 11 15
	14	13 20 17 15 17 20	16 10 15 16 7
Group - 3/4	15	13 16 9 8 12 17	15 9 14 8 10
	16	14 30 18 16 14 19	17 15 15 9 15
	17	13 30 24 17 17 16	18 20 11 20 19
	18	13 21 19 16 17 21	15 11 16 20 12
	19	17 22 12 17 16 20	21 15 17 14 19
	20	0 0 5 10 6 15	0 12 9 9 11
	21	12 25 15 15 15 15	17 11 13 7 14